Storage Ring Status

Glenn Decker

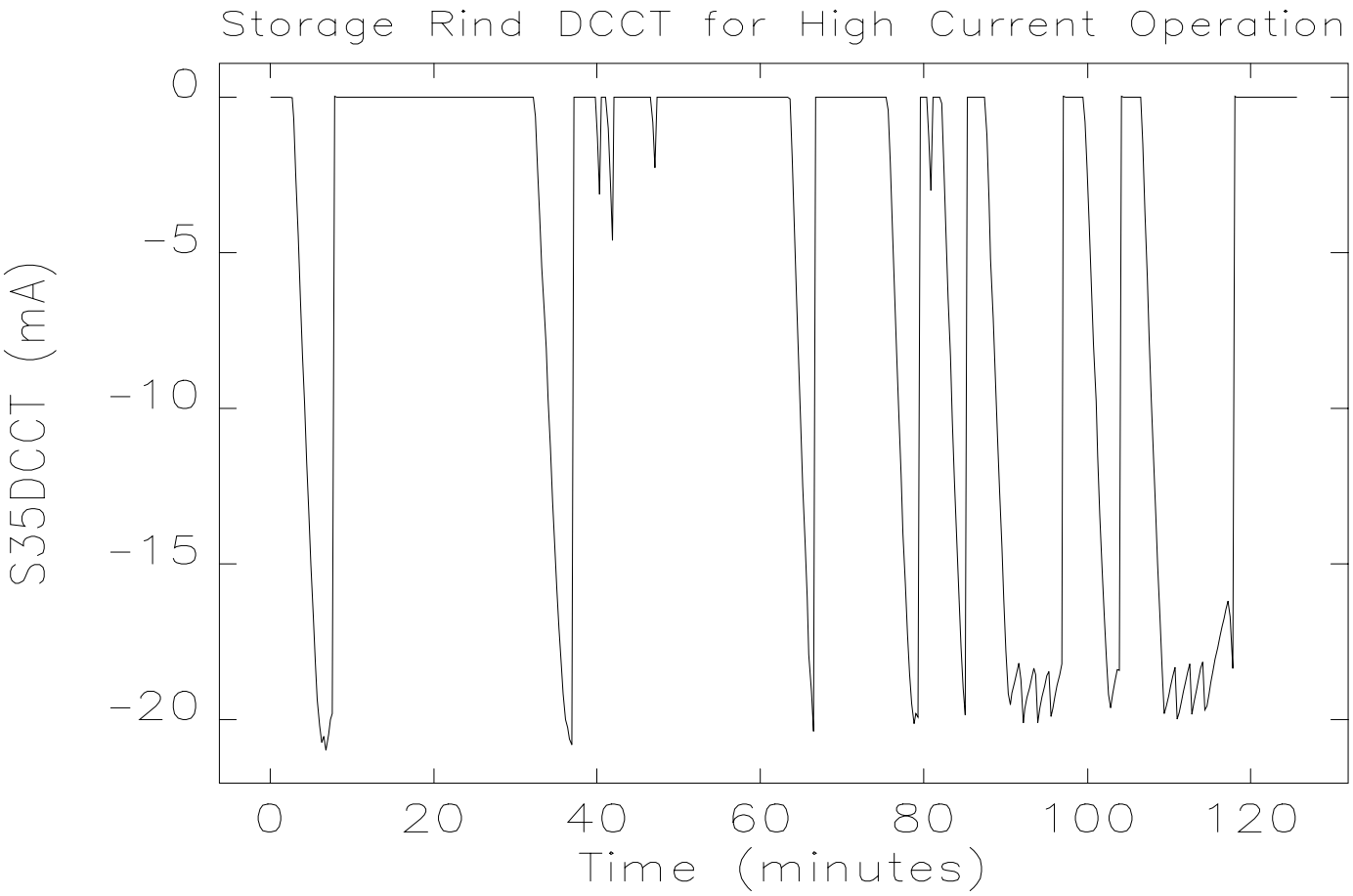
I. Performance Relative to Design Goals
   A. Beam current
   B. Vacuum
   C. Lifetime, minimum operating aperture
   D. Emittance, bunch length
   E. Beam stability

II. Commissioning and Operational Plans
   A. Near term - higher current
   B. Intermediate term - insertion device implementation
   C. Long term - positrons

Beam Current Performance to Date

I. Single bunch current
   A. Design - 5 mA maximum
   B. Actual - 9.7 mA (7/29/95): vacuum limited (1.E-6 Torr)

II. Total current
   A. 21 mA in 12 equally spaced bunches (7/31/95)
   B. Vacuum trip threshold raised for this shift
   C. Intensity limitation mechanism not investigated


Storage Rind DCCT for High Current Operation
S35DCCT (mA)
0
-5
-10
-15
-20
0
20
40
60
80
100
120
Time (minutes)

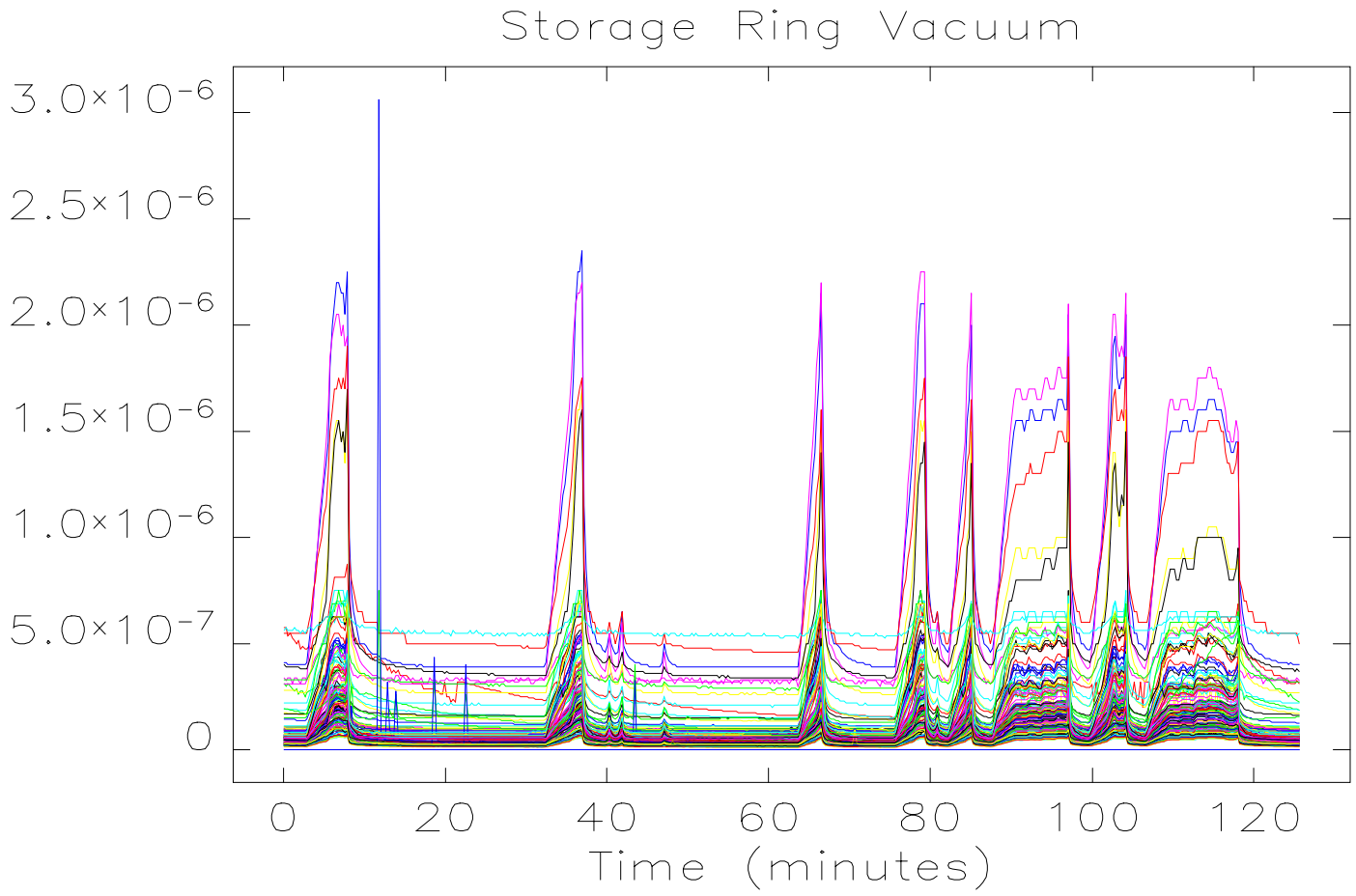
Ring Vacuum Performance

I. To date, commissioning has proceeded with 2E-8 Torr average ring base pressure.

II. Pressure increases by more than an order of magnitude with 5 mA stored beam.

III. Pressure increase composed of prompt and decaying component. These correspond to x-ray outgassing plus a thermal component.

IV. Vacuum system repairs, bakeout complete for 10/95 studies run. Few E-10 Torr base pressure expected.


Storage Ring Vacuum
3.0×10⁻⁶
2.5×10⁻⁶
2.0×10⁻⁶
1.5×10⁻⁶
1.0×10⁻⁶
5.0×10⁻⁷
0
0
20
40
60
80
100
120
Time (minutes)

Scraper Lifetime Measurements

I. Data indicated that 8 mm full aperture insertion device vacuum chamber allows acceptable operation.

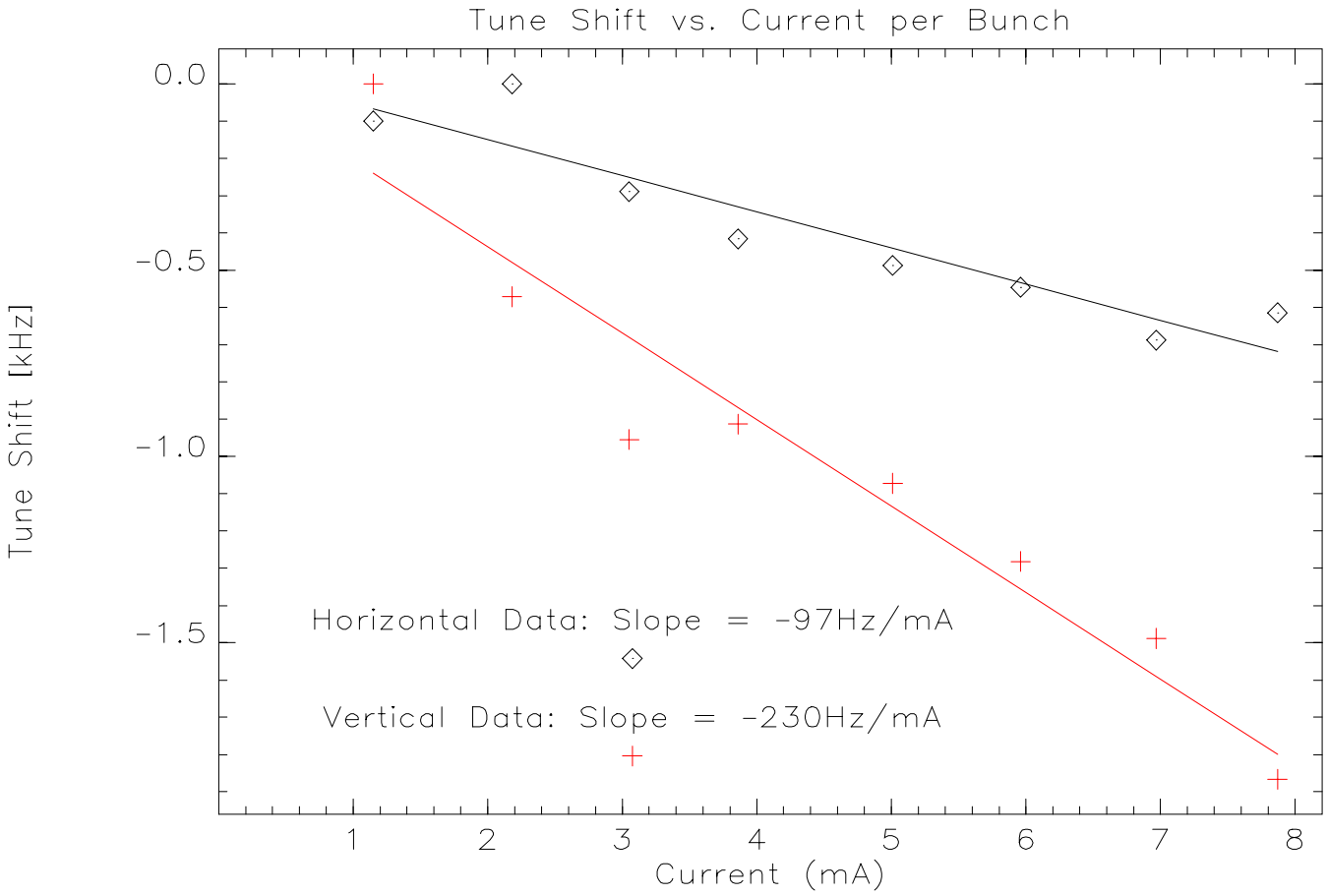
II. Lifetime > 5 hours at low currents achieved, with average ring pressure 2E-8 Torr.

Emittance, Bunch Length

I. Initial data from 1-BM and 35-BM show horizontal spot size consistent with 8.2 nm-rad natural emittance, 9.6E-4 energy spread. Vertical spot size indicates coupling less than CDR 10% design value.

II. Zero current bunch length consistent with predictions, FWHM = 52 ps.

III. Preliminary analysis of data implies $|Z/n| \cong 0.5\ \Omega$

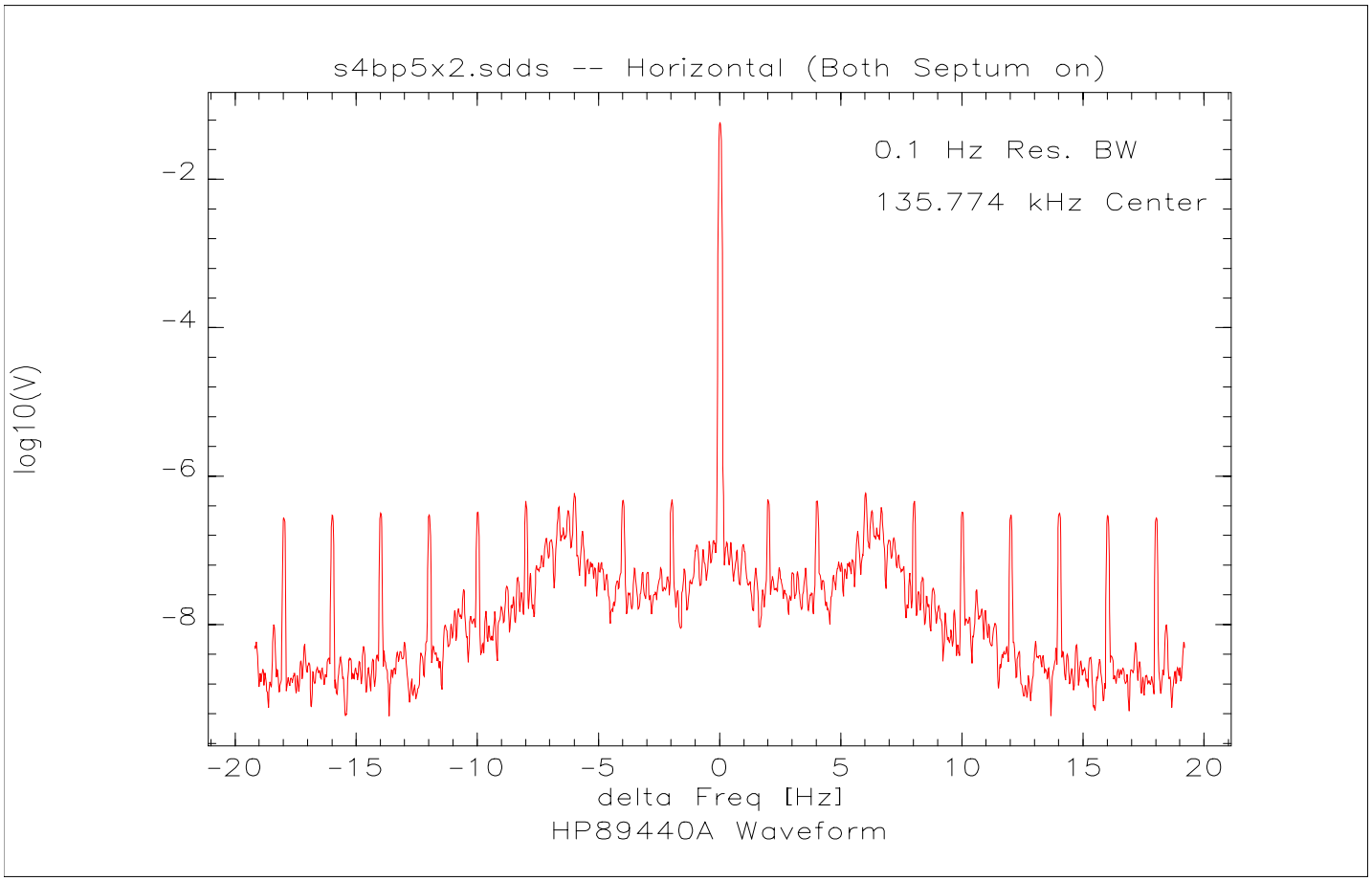

Tune Shift vs. Current per Bunch
Tune Shift [kHz]
0.0
-0.5
-1.0
-1.5
1
2
3
4
5
6
7
8
Current (mA)
Horizontal Data: Slope = -97Hz/mA
Vertical Data: Slope = -230Hz/mA

Beam Stability

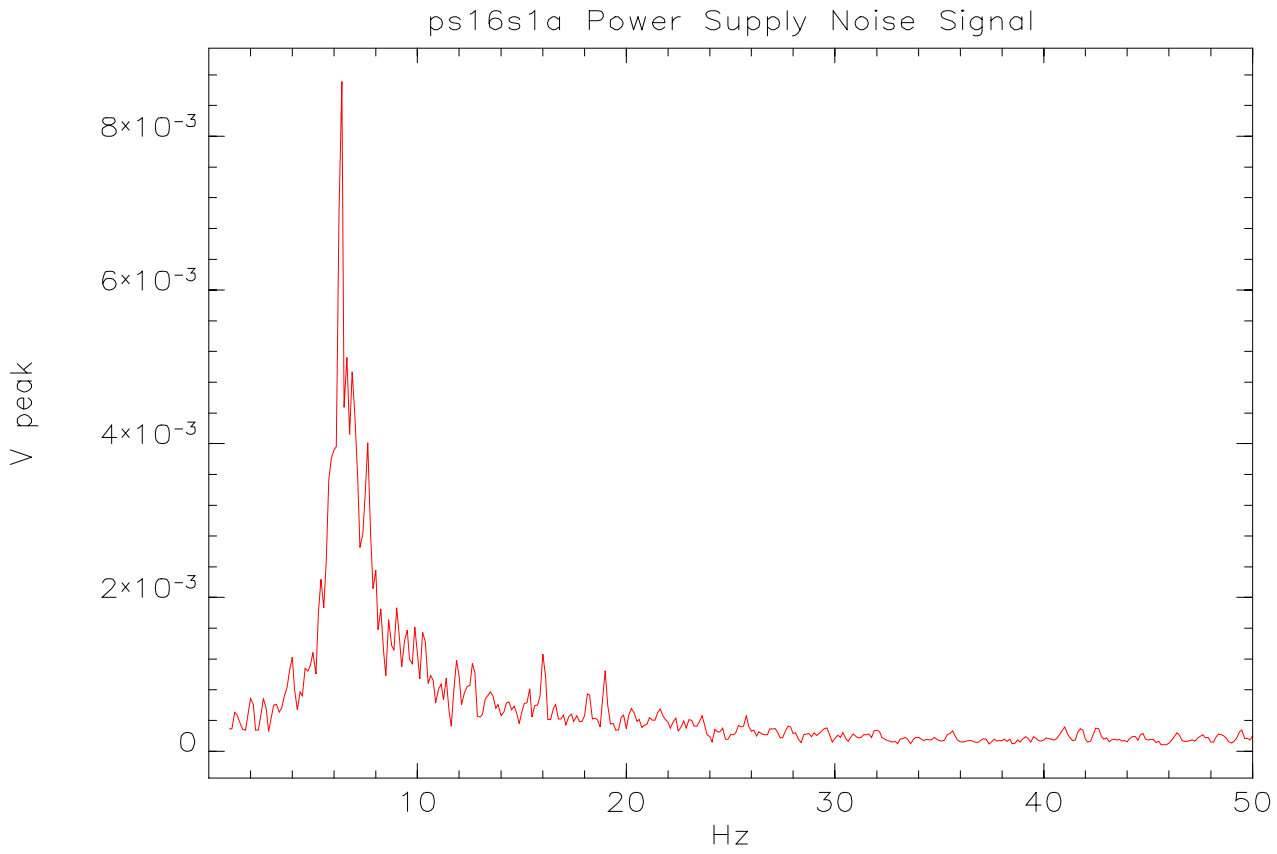
I. Able to detect rms beam motion with resolution better than 4 microns in the band 0-20 Hz.

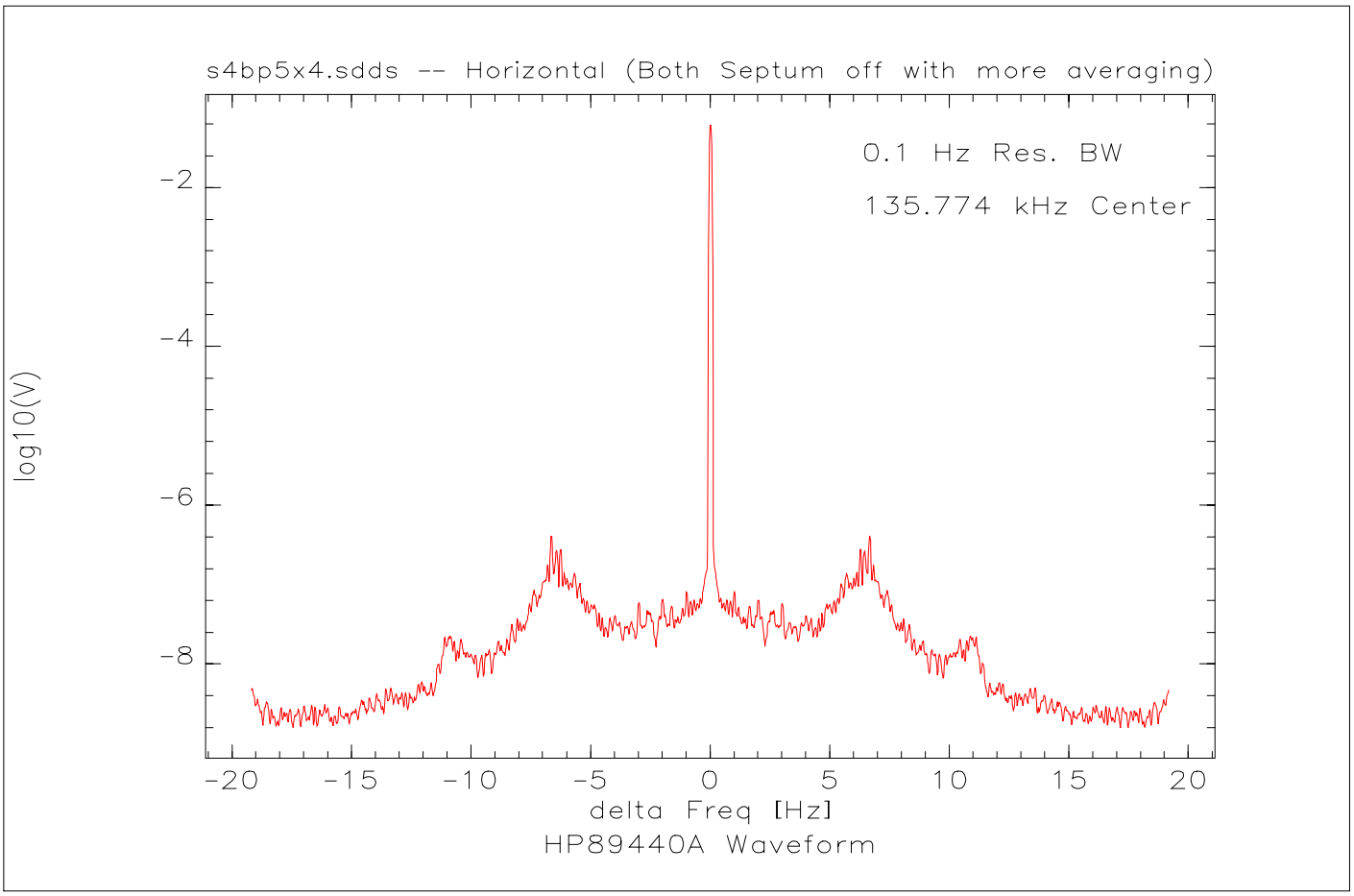
II. Unexpected horizontal 6.5 Hz beam motion found, traced to electrical noise from sextupole power supplies. Supply modifications complete.

III. Horizontal, vertical beam motions observed to be within tolerance, without feedback.


s4bp5x2.sdds -- Horizontal (Both Septum on)
0.1 Hz Res. BW
135.774 kHz Center
log10(V)
-2
-4
-6
-8
-20
-15
-10
-5
0
5
10
15
20
delta Freq [Hz]
HP89440A Waveform

The ~6.5 Hz signal seen on the S16A:S1 sextupole power supply.




s4bp5x4.sdds -- Horizontal (Both Septum off with more averaging)
0.1 Hz Res. BW
135.774 kHz Center
log10(V)
-2
-4
-6
-8
-20
-15
-10
-5
0
5
10
15
20
delta Freq [Hz]
HP89440A Waveform

Near Term Commissioning and Operational Plans

I. 100 mA operation - 10/3 commissioning period

- A. Vacuum repairs should allow full current operation
  1. Careful monitoring of vacuum as intensity increased
  2. Vacuum conditioning with beam to improve lifetime
- B. Chamber cooling will be in place
  --> Passively safe from BM radiation up to 100 mA
  --> Careful logging of absorber temperatures
- C. Machine protection system (MPS) hardware in place
- D. Efforts will focus on understanding intensity limits

II. Impedance studies

- A. Bunch length vs. synchrotron tune
- B. Synchronous phase vs. current
- C. Few vs. many bunch vacuum vs. time dependence
- D. Damping time studies

Intermediate Term Commissioning Plans

III. Higher current (> 1 mA) insertion device operation

A. MPS beam position limits detector (BPLD) will allow higher current ID operation

B. Implementation of BTS and SR scrapers to limit radiation levels at insertion device locations

IV. Feedback system commissioning

A. Local feedback (angle & position) for 1-ID

B. RF BPMs used initially

Long Term Commissioning and Operational Plans

I. November, December runs planned using bremsstrahlung-pair-produced electrons to verify linac reliability.

II. Decision to change over to positrons could occur January, 1996.

III. FY 96 operating schedule constrained by front end, insertion device installation schedule.